



Climate Change Saskatchewan

CLIMATE CHANGE EDUCATION

**Cross-Reference Between
Saskatchewan Core Curriculum &
Selected Instructional Resource Materials**

**SCIENCE 10, BIOLOGY 20, BIOLOGY 30
CHEMISTRY 20, CHEMISTRY 30
PHYSICS 20, PHYSICS 30**

Secondary Level: Grades 10 - 12

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**SCIENCE 10, BIOLOGY 20, BIOLOGY 30
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SECONDARY LEVEL: Grades 10 - 12

Major entry points - such as Knowledge, Skills and Attitude objectives - have been selected, including other statements and ideas from activities. Professional teachers may make other connections as they integrate instructional resources dealing with the topic of Climate Change.

LEGEND

- **GT** (Green Teacher)
- **PIAD** (Pembina Institute for Appropriate Development)
- **SEEDS** (Society, Environment & Energy Development Studies Foundation)
- **TEA** (Toronto Environmental Alliance)

KEY REFERENCES

GT. Green Teacher. (2001). Teaching About Climate Change. Cool Schools Tackle Global Warming. Gabriola Island BC: New Society Publishers. (www.newsociety.com) ISBN 0-86571-437-1

PIAD. Pembina Institute for Appropriate Development. (1999). Climate Change. Awareness and Action Education Kit. Drayton Valley AB: PIAD. (www.pembina.org) ISBN 0-921719-26-4

Science. A Curriculum Guide for the Elementary Level. (1995).

SEEDS. Society, Environment and Energy Development Studies Foundation. (2001). Creating a Climate of Change. Resources for Teachers. Calgary AB: SEEDS. (<http://greenschools.ca/SEEDS>) ISBN 0-9689830-0-6

TEA. Toronto Environmental Alliance. (1997). Our Changing Climate. (Learning How to Take Charge of Climate Change at School, Home and in the Community.) Toronto ON: TEA. (tea@web.net)

SECONDARY LEVEL SCIENCE
(Grades 10 – 12)

Grade 10 Science Curriculum

Instructional Resources

Earth/Environmental (p. 84)

A-2. Examine the impact of historical and contemporary human activity on the biosphere.

A-4. Identify ways that the impact of human activity can be reduced.

A-6. Analyze the effect/impact of the environment on personal activities and lifestyles, and the effect of personal activities on the environment.

A-9. Understand that technology both shapes and is shaped by society.

Greenhouse Effect (p. 86)

A-2.4. Consider opposing positions by scientists regarding the validity of the theory of the Greenhouse Effect.

A-2.7. Suggest how deforestation may contribute to the Greenhouse Effect.

A-2.9. Investigate predictions regarding climatic changes resulting from the Greenhouse Effect.

A-2.10. Suggest how agriculture in Saskatchewan may be affected by global warming.

A-2.11. Research existing policies or legislation which attempt to reduce the production of greenhouse gases.

GT

- pp. 2-4. “...Context...”

- pp. 40-43. “Going Off-Ramp...”

- pp. 64-66. “...Sustainable Living...”

SEEDS (pp. 6-1 to 6) “Climate Change ...Adaptation and Mitigation.”

GT

- pp. 17-19. “...Good for Us?”

- pp. 53-55. “Taking Action...Schools.”

- pp. 59-60. “...Hot Water.”

- pp. 49-52. “...Costs of Cars.”

SEEDS

- pp. 2-1 to 8. “Greenhouse Effect.” [Most objectives]

- pp. 3-6. “...Future Greenhouse Gases...”

PIAD (pp. 1-6, 14-15, 17-20. LA1: “Greenhouse Earth & Effect.”
[Many objectives; integrate with Social Studies]

GT

- pp. 2-4 “...Context...”

- p.18. “...Good for Us?”

- pp. 9-10. “Greenhouse Effect.”

SEEDS

- pp. 6-1 to 6. “Climate Change ...Adaptation and Mitigation.”

- pp. 7-1 to 6. “...Technology and Energy Efficiency.”

Grade 10 Science Curriculum (continued)

Instructional Resources

Uranium (p. 87)

A-3.19 Use risk analysis to compare the risks and benefits of peaceful uses of nuclear energy.

GT (pp. 59-60). “Climate Change Round Table.”
TEA (pp. 92-95). L17: “Roundtable Discussion.”

A-3.20 Develop personal value positions regarding the use of nuclear energy.

Energy Management (p. 90)

B-2.3 Understand the importance of conservation as a strategy for protecting and extending available energy supplies.

GT (pp. 40-43) “Going Off-Ramp...”
SEEDS (pp. 6-4 to 5) “...Mitigation...Climate Change.”

B-2.4 State various types of renewable and nonrenewable energy sources.

B-2.5 Recognize those forms of energy on Earth that are ultimately produced from the sun’s energy.

GT (pp. 22-24) “...Solar Electricity.”

B-2.6 Consider the implications of current energy use patterns for renewable and nonrenewable energy resources.

PIAD (pp. 98-102) LA5: “Global Impacts of Climate Change.”

B-2.8 Explain the relationship that exists between global population growth and energy demand.

GT (pp. 25-27) “Solar Box Cooking.”
PIAD (pp. 258-280) LA13: “Energy...Doesn’t Cost”

B-2.9 Explain how individuals can develop community awareness strategies for energy conservation.

GT
• pp. 35-36. “...Cyclists...”
• pp. 40-43. “Going Off-Ramp...”
• pp. 64-66. “...Sustainable Living...”

B-2.18 Reexamine scientific and technological issues related to the use of fossil fuels.

SEEDS (pp. 7-1 to 6) “...Technology and Energy Efficiency.”
[Other objectives too.]

B-2.19 Determine some of the advantages and disadvantages of using specific sources of energy.

GT (pp. 9-10) “Greenhouse Effect”
PIAD (pp. 274-282) LA13: “Energy...Doesn’t Cost”

Grade 10 Science Curriculum (continued)

Instructional Resources

B-2.20 Investigate the environmental consequences resulting from the use of various types of energy.

B-2.21 Recognize the need for conservation and energy resource management.

GT

- pp. 53-55. "Taking Action...Schools."
- pp. 56-58. "...Cool Schools..."
- pp. 59-60. "...Hot Water."
- pp. 64-66. "...Sustainable Living..."

PIAD

- pp. 243-251. LA12: "...Insulation Materials."

B-2.22 Consider how public opinion regarding energy resource development can be influenced.

- pp. 125-136. LA7: "Polarized Perspectives."
- pp. 137-164. LA8: "Politics, Power and Public Opinion."
[Integrate with Social Studies 10.]
- pp. 291-296. LA14: "Changing the World."

B-2.23 Examine and evaluate options for energy resource management, as a responsible citizen who is striving to attain scientific and technological literacy.

GT

- pp. 53-55. "Taking Action ...Schools."
- pp. 59-60. "...Hot Water."
- pp. 64-66. "...Sustainable Living..."

Science Challenge (p. 98)

D-2.4 Use a wide variety of [learning/teaching material] resources and techniques when conducting research.

GT (pp. 53-55) "Taking Action...Schools."

PIAD

- pp. 221-240. LA11: "Cars, Carbon and Climate Change."
- pp. 252-257. LA12: "Waste Not, Watt Not!"
- pp. 258-280. LA 13: "Energy...Doesn't Cost."

D-2.9 Recognize bias in resources materials.

PIAD (pp. 65-82) LA4: "Balance of Evidence."

GT (pp. 69-70) "Climate Change Round Table."

Grade 10 Science Curriculum (continued)

Instructional Resources

Science Fair Topics (p. 102)

- | | |
|--|--|
| • How can a model be developed to illustrate the Greenhouse Effect? | GT (pp. 9-10) “Greenhouse Effect.”
[See Section A-2 above.] |
| • How are greenhouse gases added to the atmosphere? | SEEDS (pp. 2-1 to 8) “Greenhouse Effect.”
PIAD (pp. 36-39) LA2: “Greenhouse Gases.” |
| • How does deforestation contribute to the Greenhouse Effect? | |
| • What are some of the long-term implications of the Greenhouse Effect on agriculture in Saskatchewan? | GT (p. 18) “... Good for Us?” |
| • What are the risks and benefits of the use of nuclear energy for peaceful purposes? (p. 103) | SEEDS (p. 7-6) “Nuclear Energy...” |
| • How do different types of home insulation compare in R-values? (p. 104) | SEEDS (p. 7-5) “Heating...R2000...”
PIAD (pp. 243-251) LA12: “...Insulation Materials.” |
| • How can landscaping be used to improve the energy efficiency of a home? | SEEDS (p. 6-5) “...tree planting...” |
| • How could a greenhouse be developed to exploit waste heat in an industrial facility? | |

BIOLOGY 20 Curriculum

Instructional Resources

Ecological Organization (p. 96)

- 1.4. Describe how climate variations in Saskatchewan influence plant growth.
- 1.8. Appreciate that the soil and the climate are the keys to life in Saskatchewan, and on this planet.
- 1.10. Investigate the interrelationships of agriculture and the environment.
- 2.5. Describe how the human community in which one lives is dependent on, and influenced by, the climate.
- 2.11. Identify how human activity (e.g., agriculture and urbanization) has altered success or changed its rate.
- 3.3. Investigate the role of humans in creating and sustaining conditions which alter the rate of ecological damage.
- 5.4. Discuss the carrying capacity of planet Earth for the human population (p. 97).
- 6.3. Draw a climatogram and discuss temperature and moisture as major determiners of a specific ecological area.
- p. 97, Activity 1. Study an ecological problem.forest cutting and management techniques...Create a situation where there is more harmony between the environment and the needs of people.
- SEEDS** (pp. 2-5 to 6) [Cycles.]
- PIAD** (pp. 21-39) LA2: “The Carbon Connection.”
- GT** (pp. 17-18) “...Good for Us?”
- PIAD** (pp. 7-13, 16-20) LA1: “Biosphere Bottle.”
- GT** (pp. 64-66) “...Sustainable Living...”
- SEEDS** (pp. 6-1 to 6) “Climate Change...Adaptation and Mitigation.” [See Social Studies 20 Unit.]
- PIAD** (pp. 103-123) LA6: “Impact of Climate Change in Canada.” [Biomes]
- SEEDS**
- p. 1-1. “Climatographs.”
 - pp. 2-1 to 2. “...Earth’s Climate...”
 - pp. 3-1 to 7. “Past and Future Climates.”

BIOLOGY 20 Curriculum (continued)

Instructional Resources

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- p. 98, Activity 2. Environmental impact [study].
GT (pp. 64-66) “...Sustainable Living...”
SEEDS (pp. 6-1 to 6) “Climate Change... Adaptation and Mitigation.”
 - p. 100, Activity 19. Was the “Greenhouse Effect” unit covered in the Grade 10 Science course or will you integrate it here?
GT (pp. 9-10) “Greenhouse Effect.”
SEEDS (pp. 2-2 to 8) “Greenhouse Effect... [and Greenhouse Gases.]”
PIAD (pp. 1-20) LA1: “Greenhouse Earth and Effect.”
 - p. 100, Activity 24. What are the implications of the 3R’s [Reduce, Reuse, Recycle] for the environment?
GT
 - pp. 53-55. “Taking Action ...Schools.”
 - pp. 56-58. “...Cool Schools...”
 - pp. 59-60. “...Hot Water.”

The Diversity of Life (p. 107)

- p. 107, Activity 18. How has human culture had an effect on the changes in the kinds of organisms in your area and the province as a whole?

Agricultural Botany of Saskatchewan (p. 111)

- 4. Recognize the interconnectedness of agriculture and the environment.
 - 4.1. Describe the impact of agriculture on the local environment.
 - 4.2. Identify local and global issues related to agriculture.
 - p. 112, Activity 1. Rangeland management. Discuss the science and technology associated with agricultural practices. Brainstorm for social, economic, cultural, and environmental impacts.
- p. 112, Activity 14. [Sustainable Farming]. ...how... to achieve an agricultural system that is economically and environmentally sustainable.
GT (pp. 69-70) “Climate Change Round Table.”
PIAD (pp. 258-280) LA13: “Energy...Doesn’t Cost.”

BIOLOGY 30 Curriculum

Instructional Resources

Cell Structure and Function (p. 124)

2.5. Describe the processes involved in photosynthesis.

2.6. Examine how the structure of the leaf is adapted for the processes involved in photosynthesis.

Evolution. (p. 139)

2.5 Examine broad climatic changes during the earth's history (ice ages, melting of the ice caps) and consider how these changes may have contributed to the changing organisms.

GT

- p. 15. "...Climate Variability..."

- p. 31. "...Biomass."

SEEDS (p. 7-4) "...ethanol..."

PIAD (pp. 23, 34, 36) LA2: "Carbon Connection."

GT (pp. 14-16) "...Climate Variability..."

Chemistry 20 Curriculum

Instructional Resources

Introduction to Chemistry (p. 78)

Understand how application of chemical principles through technology influences the natural environment.

- p. 88. Independent Research: ... [conduct] investigative research into an issue of current societal concern in the community.

GT

- pp. 2-4. "...Context..."
- pp. 49-52. "...Costs of Cars."
- p. 57. "...Cool Schools...[CO₂]"

Mole Concept and Stoichiometry (p. 111)

When coal is burned, sulphur impurities in the coal also burn. How many tonnes of sulfur are found in the Saskatchewan coal burned each year?

GT (pp. 9-10) "Greenhouse Effect."

Consumer Chemistry (p. 116)

Understand the political, social and consumer demands which create and sustain technological developments.

GT

- p. 39. "...Public Transit."
- pp. 64-66. "...Sustainable Living..."
- SEEDS (pp. 7-1 to 3) "...Technology and Energy Efficiency."

- p. 117, Activity. What chemical compounds are emitted from cars?

GT (pp. 50, 52) "...Costs of Cars."

- p. 120, Activities. ... use of fossil fuels.... laws....; coal contains sulphur. Can the sulphur oxides be removed from the smoke?

Chemistry 30 Curriculum

Instructional Resources

Case Study (p. 134)

- Read and interpret quantitative information from a variety of sources.
- Evaluate arguments based on quantitative information.

GT

- pp. 49-52. "...Costs of Cars."
- pp. 69-70. "Climate Change Round Table."

Energy Changes in Chemical Reactions (p. 140)

- Relate the theoretical aspects of the study of energies of reactions to daily, practical experiences with energy produced by and consumed by reactions.
- Burning fossil fuels produces most of the heat that we use in North America. ... compare efficiency of heat production...(p. 141)

Physics 20 Curriculum

Instructional Resources

Discovering Physics (p. 86)

Which brand of 100 W incandescent light bulbs burns the brightest, produces the “softest” light, lasts the longest, is most “durable”, is most economical, is most efficient?

PIAD (pp. 252-257) LA12: “Waste Not, Watt Not!”

Heat and Temperature (p. 121)

7. Explain the difference between heat and temperature.

PIAD (pp. 3-4; 14-15) LA1: “Simulating the Greenhouse Effect.”

9. Explain that heat can not be measured directly whereas temperature can.

- p. 122, Activity 3. Investigate various designs for active and passive solar heated homes.
- p. 122, Activity 7. Investigate the insulation values and costs of different types of commercially available insulation materials ... desired RSI value....

SEEDS (pp. 7-5) “...savings...heating...”

PIAD (pp. 243-251) LA12: “...Insulation Materials.”

Specific Heat Capacity and Latent Heat (p. 124)

6. Suggest some environmental implications leading from the physical properties of water.

- p. 125, Activity 8. Research ways in which waste heat is being put to better use than by releasing it into the environment.

- p. 125, Activity 9. Design a passive solar water heater.

GT (pp. 59-60) “...Hot Water.”

Thermodynamics (p. 126)

... no device transfers its heat energy completely into work. (A **heat pump** requires an application of work to transfer heat energy from a low temperature to a higher temperature....)

Physics 30 Curriculum

Instructional Resources

Mechanical Energy (p. 189)

4. Solve problems involving work, power, and energy.

Electricity (p. 193)

Determine the ways in which electrical energy can be conserved.

Consider some of the implications of increased energy demand in the future.

Appreciate the value and limitations of technology within society.

- p. 195, Activity 5. Investigate newer high efficiency light bulbs.
- p. 195, Activity 7. Research the major methods that are used for generating electrical energy in Saskatchewan and elsewhere in Canada. Identify the advantages and disadvantages of each method, noting the impact each has on the environment. ...NIMBY ... SaskPower...

Electric Power and Energy (p. 206)

The cost of electricity ... The demand for electrical energy has increased dramatically in recent years. Conserving electrical energy is important.

9. Identify the main ways that are used to produce electricity in Canada (p. 207).
10. Identify the impact and main method used to produce electricity has on the environment.
11. Compare the methods used to produce electricity in Canada and determine which is most likely to be the most and least desirable. Debate the choices selected.

GT

- pp. 35-36. "...Cyclists."
- p. 60. "...Hot Water."

GT

- pp. 53-55. "Taking Action ...Schools."
- pp. 55-58. "...Cool Schools...."
- pp. 59-60. "...Hot Water."

SEEDS (pp. 6-4) "...mitigation..." [Energy Use]

GT (pp. 64-66) "...Sustainable Living..."

SEEDS (pp. 7-1 to 6) "Technology and Energy Efficiency."

(See page 86 above.)

GT

- pp. 22-24. "...Solar Electricity."
 - p. 31. "Hydropower."
 - pp. 69-70. "Climate Change Round Table."
- PIAD** (pp. 274-280) LA13: "Energy...Doesn't Cost."

SEEDS (pp. 7-1 to 5). "...Technology and Energy Efficiency."

Physics 30 Curriculum (continued)

Instructional Resources

- p. 207, Activity 2. Have students design and conduct an activity to determine the cost of using electricity for a “typical” household in Saskatchewan over a given amount of time.
GT (pp. 59-60). “...Hot Water.”
- P. 207, Activity 4. Compare the cost of using electricity or the pricing policies in Saskatchewan with that of other provinces or other countries.
PIAD (pp. 252-257). LA12: “Waste Not, Watt Not!”

Nuclear Fission (p. 215)

7. Compare the amount of energy released during a fission reaction with the amount of energy released during the combustion of a typical fossil fuel.

Nuclear Reactors (p. 217)

The use of nuclear energy is controversial. ... Instead of demanding more and more energy, at the expense of the environment and our resources, individuals, institutions, and government all have to search for ways to conserve energy. ... Can we reach sustainable development?

11. Suggest what concerns regarding environment emerge as a result of the use of nuclear energy (p. 218).

Nuclear Fusion (p. 270)

Nuclear fusion occurs within the sun and the stars. Sunlight is energy released from fusion reactions in the sun.

3. Explain that nuclear fusion occurs within the sun and the stars (p. 271).
9. Suggest the potential that fusion has for providing an abundant supply of energy.
SEEDS (p. 1-2). “...sun ...solar energy...”
- 9/10 Develop/defend a position which either supports or rejects the use of nuclear energy for a specific application (p. 273).
GT (pp. 69-70). “Climate Change Round Table.”

- p. 273, Activity 2. Conduct a formal or informal debate to resolve the important issues regarding nuclear energy.
- p. 273, Activity 4. ...obtain a wide variety of resource materials dealing with the application of nuclear energy.

